EPA United States Environmental Protection Agency

Air and Radiation (6202J)

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APPLICATION PROFILE

Daylight Dimming in Retail Facilities

EPA Green Lights
an ENERGY STAR program

McDonald's

Fair Haven, Vermont
McDonald's

Owner: Lloyd Schneider

Contractor: Electronic Lighting Inc.

Utility: Central Vermont Public Service Corporation

PROJECT RESULTS

Incremental Savings from Daylight Dimming	
Energy Savings	29%
Installed Cost	$424
Rebate	$240
Internal Rate of Return	50%
Simple Payback	1 year
Annual kWh Savings	1,908 kWh
kW Savings	.392 kW
Pollution Prevented	
CO_2	2,099 lbs/yr
SO_2	16.8 lbs/yr
NO_x	5.89 lbs/yr

TYPICAL APPLICATIONS

- Stores with Large Windows
- Stores with Skylights
- Malls
- Fast Food Restaurants
- Store Fronts and Display Windows

DAYLIGHT DIMMING

Using Free Natural Light to Save Electricity

Daylight is a valuable asset to improve sales in retail operations. Many stores and malls use windows and skylights to allow daylight to enter for general illumination. Whether a mall is using skylights for the common areas or an individual store is using large windows at the entrance or around the entire perimeter, there is usually an abundant amount of daylight entering these spaces... but the electric lights are still on. In most circumstances, the contribution from the electric lights is minimal compared to the contribution from the natural light.

A daylight dimming system can help save energy and money and improve the aesthetics of the space by taking advantage of the available daylight. Systems are available for dimming fluorescent and HID lamps to a predetermined light level. In some instances when more than enough daylight is available, the electric lights will dim to their lowest level — typically 20 percent full output for fluorescent systems.

Benefits

- Energy savings can be as great as 40%; additional savings can be achieved due to reduced air-conditioning requirements.
- The daylight dimming system can also significantly reduce electricity demand (kW) charges because daylight typically coincides with the utility's peak demand profile.
- Lighting quality is enhanced by maintaining a more constant and uniform light level.
- Over the life of the lighting system, a reduction in light output due to normal dirt and lamp depreciation is not noticeable. The dimming system adjusts to maintain a constant light level.
- A daylight dimming system provides flexibility in light levels. The photosensor can be manually adjusted to provide the desired amount of illumination.

Issues

- The system must be commissioned immediately after installation and annually maintained. Due to varying site conditions, daylight systems must be properly positioned, adjusted and tuned for the best response to individual zone conditions. Check with the sensor manufacturer for proper calibration methods.
- Energy and demand savings can widely vary based on weather conditions, building orientation, glazing, interior decorations and other obstacles which could restrict daylight from entering.
- Check with the manufacturers for equipment compatibility. Due to the large number of dimming ballast and photosensor manufacturers, some components might not be compatible.
- Daylight dimming strategies can be used for controlling high intensity discharge (HID) systems. Check with HID lamp manufacturers regarding impacts of dimming on color shift and lamp life.

MANUFACTURERS OF DIMMING BALLASTS AND CONTROLS

- Advance Transformer
- Bryant Electric
- Conik Technologies
- Crownlight Manufacturing
- Dark to Light
- Davis Controls
- Flexiwatt
- Dynamic Energy Products
- EBT
- Eclipse Technologies
- Electronic Lighting Inc.
- Energy Savings Inc.
- Etta Industries
- Finelite
- GE
- Genlyte
- Holophane
- Lightscience Corporation
- Litetronics
- Lithonia
- Lutron Electronics
- Magnetek
- Motorola
- PLC
- Pass & Seymour
- Powerline Communications
- Prescolite Controls
- Robertson Transformer
- Solium Inc.
- Stocker & Yale
- Tek-Tron
- TORK
- Watt Stopper

Call the Green Lights Hotline at 1-888-STAR-YES for addresses and phone numbers of Green Lights Allies.

CASE STUDY

Fair Haven, Vermont

McDonald's

"The customers and the employees never even notice the lights are dimmed."

- Lloyd Schneider, Owner

Fast-food restaurants are known for their quick service and bright interiors. The Fair Haven Vermont McDonald's is no exception. Similar to most McDonald's restaurants, the Fair Haven McDonald's has large windows surrounding the dining area. During the day, plenty of natural light enters through the windows. Although the natural light provides an average of 130 footcandles, the fluorescent lights were still on during the entire business day.

Electronic Lighting Inc. (ELI) approached Lloyd Schneider, the owner of the restaurant, and discussed the potential energy savings opportunity. After realizing the opportunity, Lloyd had ELI install their Daylight Harvesting System to control 14 fluorescent fixtures in the dining area. The fixtures are divided into four different zones, each zone being controlled by one photosensor.

During the day, the lights automatically dim to their lowest level — about 40 percent full power. According to Lloyd, neither the employees nor the customers notice that the lights are dimmed.

The daylight dimming system is part of a comprehensive upgrade that included retrofitting all fluorescent fixtures with T8 lamps and electronic ballasts, replacing incandescents with compact fluorescent lamps, and installing LED exit signs. Combining all these upgrades gave the entire project a payback of less than one year. However, the daylighting upgrade did not need any help — it would have paid for itself in less than 2.5 years.

Now that's what is called an extra-value.

Facility Information:

14 fixtures
2 T8 lamps per fixture
One dimming ballast per fixture
Four daylight zones
One sensor per zone
Lights on 20+ hours a day

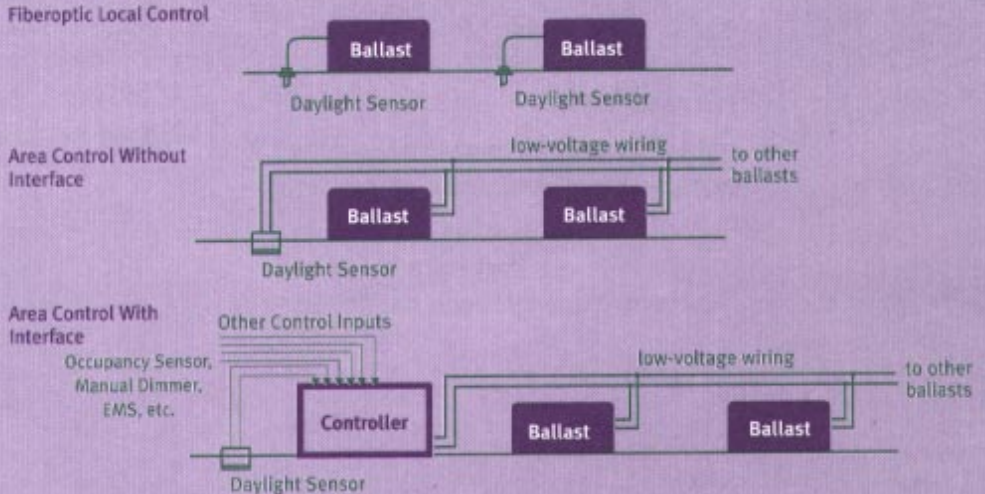
Equipment Information:

ELI Series 700 Dimming Ballast
ELI DHS Photosensor

Project Costs and Savings

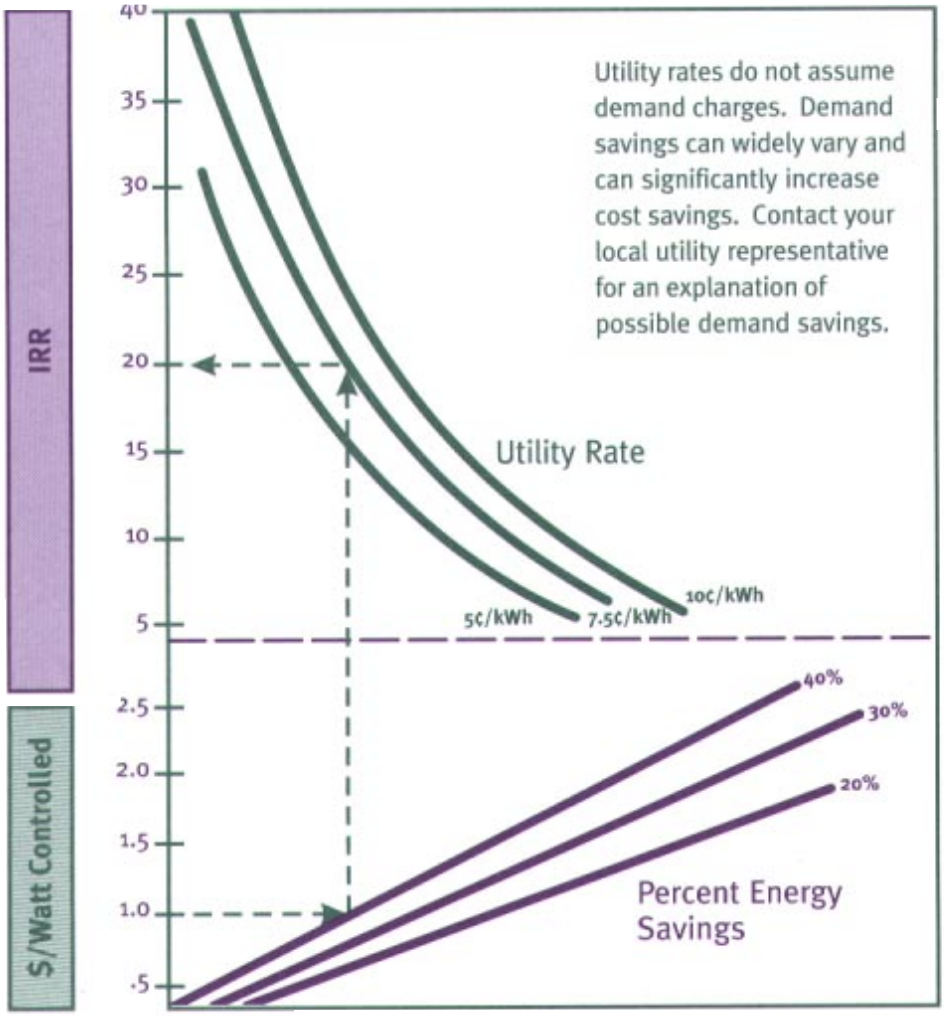
	4 Lamp T12 Fluorescent Upgraded to 2 Lamp T8 w/ Full Output Elec. Ballast	4 Lamp T12 Fluorescent Upgraded to 2 Lamp T8 w/ Dimming Elec. Ballast	Incremental Costs & Savings From Dimming
Installed Cost	$343	$767	$424
Annual kWh Savings	14,700 kWh	16,608 kWh	1,908 kWh
Cost Savings	$1,397	$1,578	$181
Energy Savings	69%	78%	29%
Simple Payback	.25 yrs	.5 yrs	2.4 yrs
IRR	368%	172%	31%
Results with Rebate			
Rebate	N/A	$240	$240
Adjusted Cost	N/A	$527	$184
Adjusted Simple Payback	N/A	.33 yrs	1 yr
Adjusted IRR	N/A	224%	50%

Daylight Dimming System Equipment Options:



WILL IT WORK FOR YOU?

INCREMENTAL COST ANALYSIS FOR DAYLIGHT DIMMING SYSTEMS



Use this graph to estimate the cost-effectiveness of installing daylight dimming systems in your facility.

1. Determine your installed cost of the dimming system per watt controlled and mark this point on the graph. *For example, a $4,000 installed cost for controlling a 4,000-watt (four kW) lighting load would be $1.00/watt.*
2. Draw a horizontal line from this point until it intersects the curve that represents the percent energy savings expected from the dimming system. *For our example, the system will save about 40 percent.*
3. Draw a vertical line from this point until it intersects the curve that represents your average electricity rate. *In our example, the electricity rate is 7.5 cents per kilowatt-hour.*
4. Draw a horizontal line from this point until it intersects the vertical axis that measures the internal rate of return. *Our sample upgrade earns an after-tax internal rate of return of 20 percent.*

The Green Lights Program offers 2-day Lighting Upgrade Workshops, Application Profile brochures, and other technical support services to assist program participants in applying cost-saving lighting strategies. For more information, call the Green Lights Hotline at 1-888-STAR-YES.

Graph Assumptions

- Post-tax analysis: marginal income tax rate of 30 percent
- 3% inflation for energy and maintenance costs
- No demand savings
- Half of cost ($/watt controlled) is for materials, half is for labor
- 3,500 hours/year of lighting operations